Topics in Biophysical Chemistry — CHMC21H3 Fall 2017

Lectures: Wednesday, 12:00–14:00, AA208
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Office Hours: Fridays, 10:00–12:00

Welcome to Topics in Biophysical Chemistry! In a nutshell, Biophysical Chemistry is a field of study that focuses on how basic physical principles govern structure, function, and behaviour of biological systems. As the field is broad covering topics as diverse as molecular imaging, signal transduction, energetics of transport across membranes, protein folding, biological energy conversion, and rational drug design, emphasis will be given to state-of-the-art biophysical techniques used to characterize these biological processes as well as biomolecules and cells, at a single-molecule and single-cell resolutions. With all the recent breakthroughs and advances in optical and force techniques that opened the window to previously unobserved details of biological structures and processes—it's such an exciting time to peek through the myriad of reactions inside a living cell, elucidate molecular mechanisms and quantify biophysical interactions!

At the end of this course, you are expected to:

1. Apply your knowledge on the fundamental concepts in physical chemistry to explain biological systems and observations at the molecular level;
2. Develop familiarity with current and state-of-the art biophysical techniques increasingly used in the study of complex biological processes and systems at different length- and time- scales;
3. Critically evaluate experimental data and integrate a suitable combination of techniques in addressing a biological question; and
4. Communicate a specialized topic—both at its most basic level and broader-theme application.

Method of Evaluation

Course Component	Percentage
Problem Sets	35%
Midterm Exam	20%
Critical reading of the literature + Oral presentation	10%
Final Exam	35%

Communication

Check the Blackboard for important announcements. Readings, journal articles, and other relevant materials will be posted on Blackboard throughout the course. You may access it at: https://portal.utoronto.ca

Recommended Textbooks

1. *Physical Chemistry: Principles and Applications in the Biological Sciences* 5th Ed. by Tinoco, Sauer, Wang, Puglisi, Harbison, Rovnyak; 2013.
2. *Biophysical Chemistry* by Allen; 2008.

Tentative Course Schedule

Week	Date	Topic	Due
1	Sept 6	Course Overview	
2	13	Fluorescence microscopy	
3	20	Fluorescence microscopy of biological processes + current advances on live cell imaging	
4	27	Force-based manipulation and detection of biological processes	Problem Set 1
5	Oct 4	Single-molecule force spectroscopy: models and analysis	
6	11	**Reading Week**	
7	18	Midterm Exam	Problem Set 2
8	25	Material characterization and quantitative imaging by atomic force microscopy + correlative microscopy	
9	Nov 1	Case in point: biophysics of membranes	
10	8	Dynamic biointeractions	Problem Set 3
11	15	More surface techniques: surface plasmon resonance and quartz crystal microbalance	
12	22	Oral Presentations 1*	Problem Set 4
13	29	Oral Presentations 2*	
14	Dec 6	**Study Break**	

**Student will choose a journal article whose main theme is among the topics/techniques discussed and expound on it based on defined criteria detailed in class.*

Course Prerequisites—when in doubt, talk to me!

CHMB20H3 or CHMB23H3: Chemical Thermodynamics and Elementary Kinetics or Introduction to Chemical Thermodynamics and Kinetics: Theory and Practice
CHMB21H3: Chemical Structure and Spectroscopy
MATB41H3: Techniques of the Calculus of Several Variables
PHYA21H3: Physics II for the Physical Sciences

Accessibility

Students with diverse learning styles and needs are welcome in this course. In particular, if you have a disability/health consideration that may require accommodations, please feel free to approach us and/or the Access*Ability* Services Office as soon as possible. We will work with you and Access*Ability* Services to ensure you can achieve your learning goals in this course. Enquiries are confidential. The UTSC Access*Ability* Services staff (located in S302) are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations (416) 287-7560 or ability@utsc.utoronto.ca.

Academic Integrity

Academic integrity is important to maintain our community which honours the values of honesty, trust, respect, fairness and responsibility and to protect you and the value of the degree towards which you are all working so diligently.

It is an offence for students to:

- Use someone else's ideas or words in their own work without acknowledging that those ideas/words are not their own with a citation and quotation marks. i.e. to commit plagiarism
- Include false, misleading or concocted citations in their work.
- Obtain unauthorized assistance on any assignment
- Provide unauthorized assistance to another student. This includes showing another student completed work.
- To submit their own work for credit in more than one course without the permission of the instructor
- To falsify or alter any documentation required by the University.- eg: doctor's notes
- To use or possess an unauthorized aid in any test or exam.

  There are other offences under the Code, but these are the most common.

  Please respect these rules. Offences will be dealt with according to the procedures outlined in the Code of Behaviour on Academic Matters.